Limited Visual Dam Safety Inspection Summary Report

HI - 00043

Puukapu Watershed Retarding Dam R-1

Hawaii, Hawaii

Prepared by:

U.S. ARMY CORPS OF ENGINEERS
HONOLULU ENGINEER DISTRICT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

May 2006

Dam ID: HI00043
Name: Puukapu Watershed Retarding Dam R-1

Limited Visual Dam Safety Inspection Conducted on: 6 April 2006

I. Purpose:

Due to disaster occurrences of periodic heavy rains and flooding, which has caused extensive damage to property and loss of lives, the Governor has issued a State of Emergency Proclamation extending from February 20, 2006 to April 9, 2006. In light of the tragic failure of the Kaloko dam on Kauai and the continued forecast of heavy rains, emergency inspections of all regulated dams in all counties are being undertaken.

These inspections are for the purpose of determining if any of the regulated dams and reservoirs in the City and County of Honolulu, Maui County or Hawaii County, are suspect for immediate concern to the downstream area under the prolonged conditions of heavy rain showers.

II. Authority

Inspections are authorized under the Hawaii Dam Safety Act of 1987, Chapter 179D "Dams and Reservoirs" of Hawaii Revised Statues, and Title 13, Subtitle 7, Chapter 190, "Dams and Reservoirs" of the Hawaii Administrative Rules.

These inspections were conducted under joint agreements of the U.S. Army Corps of Engineers (ACE), the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), and the State of Hawaii. The Memorandum of Agreement with the U.S. Army Corps of Engineers is entered into pursuant to 10 U.S.C. § 3036(d)(2), and the Intergovernmental Cooperation Act (31 U.S.C. §6505), and established via support agreement number DL-06-01.

III. Scope

Visual inspection was performed on parts of the embankment and appurtenant works readily available and visible for inspection by the inspection team at the time of the inspection. Such parts and appurtenant works included the upstream slope, crest, downstream slope, abutments and toes, outlet works, and spillway.

On the date of this limited visual inspection, there may or may not have appeared to be any immediate threat to the safety of the dam, however no assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

IV. Limitations of Findings and Recommendations

The inspection is based only on visible features/areas of the dam on the day of inspection. The inspection does not entail detailed stability, hydrologic, hydraulic, or seismic investigations. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies.

Dam ID: HI00043
Name: Puukapu Watershed Retarding Dam R-1

V. Inspection Team

Organization	Name /Title
U.S. Army Corps of Engineers	Joseph P. Koester
State of Hawaii, Dept. of Land & Natural Resources	Eric Tanaka
State of Hawaii, Dept. of Agriculture	Ernest Alfonso
National Resources Conservation Service	Drew Stout

VI. Owner's Representatives Present

Harry Yada, Dept. of Land & Natural Resources

VII. Summary Report Team

Organization	Name /Title
U.S. Army Corps of Engineers	Derek Chow
	Mr. Joseph Koester
State of Hawaii, Dept. of Land & Natural Resources	Denise Manuel
	Edwin Matsuda

VIII. Dam Type

The dam is an earthen embankment.

IX. Dam Classification

The current hazard classification of this dam is: High
Based on available data, this classification is believed to still be applicable.

Hazard Potential Classification based on the following:

Category	Loss of Life	Economic Loss
Low	None Expected	Minimal (undeveloped to occasional structures or agriculture)
Significant	Few (No Urban development and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	More than a few	Extensive community, industry or agriculture.

Based on inventoried storage and height data, the size classification of the dam is: Small

Size Classification based on the following:

Category	Storage (Acre-Feet)	Height (feet)
Small	< 1000	< 40
Intermediate	> 1000 and < 50,000	> 40 and < 100
Large	> 50,000	> 100

X. Summary of Inspection:

Condition Rating Criteria: The conditional terms in this report are used to generally describe the conditions below. Inspections, monitoring, and additional investigations are considered to be incidental to all condition ratings.

Satisfactory	Expected to fulfill intended function.
Fair	Expected to fulfill intended function, but maintenance is recommended.
Poor	May not fulfill intended function; maintenance or repairs are necessary.
Unsatisfactory	Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
Unknown	Not visible, not accessible, not inspected, or unable to determine the condition rating based on the observation taken.

A. General appearance:

The reservoir and dam features were easily recognizable, and the project appeared to have a small to moderate surface drainage area. The owner representative reported no incident history. There were no signs of any recent modifications.

Findings and Corrective Actions:

a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
b. An EAP is required for High Hazard Dams. Submit an updated EAP for this facility.
c. Dam owners shall provide for routine inspection of the dam.
d. Access to site appears to be satisfactory.
e. Power/Communication: There were no communication systems, utility or power poles visible on the project, except in nearby neighborhoods and along the county road (Mana Road) that transects the reservoir.

B. Access / Security:

Access to the dam was accomplished via a County roadway. Access to the dam site is by standard car, except in the event of heavy rains, when a four-wheel drive car would likely be required to traverse open fields upstream and downstream.

C. Inflow Works:

The inflow works consisted of a concrete lined ditch, roughly 5 ft deep and 12 ft wide, rectangular in shape. Flow was not controlled by any known or inspected apparatus, but was known to be measurable at a notch weir, which was not inspected. The ditch was clear and in excellent condition; no corrective actions are required at this time. In addition to inflow through this ditch, which was minimal at time of inspection, overland flow would bring water into the reservoir.
The intake works were not inspected / tested.

D. Reservoir

The reservoir level (a small pond used by livestock north of Mana Road) during the inspection was estimated to be 2-3 ft deep at the time of inspection. There was no gage. This is the normal operating level, increased only during rain events.

Findings and Corrective Actions:

a. The reservoir appeared to be in satisfactory condition, no corrective actions are required at this time.

E. Upstream Slope (Fair)

The upstream typical slope was 2-1/2 H: 1V (Horizontal / Vertical).
No slope protection was observed on the upstream slope other than well-established, uniform long grass. No erosion was observed, however, livestock have scoured a few scarps on the upstream slope, and these will erode in future rainfall. Cracks were not observed. Sinkholes were not observed.

Findings and Corrective Actions:

a. The upstream slope appeared to be in fair to poor condition and requires corrective action.
b. Rut and/or gully erosion was observed on the slope, which requires maintenance and/or repair. Corrective action required is to repair scour by livestock, re-establish grass cover, and restrict livestock access to the slope.

F. Crest: (Satisfactory)

The dam crest was approximately 13 ft wide. There was a dirt access road on top of the crest, with little traffic evident. Minor erosion was observed, limited primarily to tire ruts and some small gullies from surface drainage. Cracks were not observed, nor were sinkholes. Vegetation was observed on the edges of the crest. These were primarily small woody vegetation and high grass.

Findings and Corrective Actions:

a. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.

G. Downstream Slope: (Satisfactory)

The downstream slope was in satisfactory condition, and about the same slope as the upstream slope. There was no slope protection observed on the downstream slope.

Findings and Corrective Actions:

a. The downstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.

H. Abutments / Toe: (Satisfactory)
The downstream slope was in satisfactory condition. There was no slope protection observed on the downstream slope.

Findings and Corrective Actions:
a. The Abutment / Toe appeared to be in satisfactory condition, no corrective actions are required at this time.

I. Outlet Works: (Satisfactory)
The primary outlet works consisted of a pattern of six dry injection wells, which are 2 ft 6 inch diameter pipes covered by a concrete screen box. None were flowing at the time of inspection. Screens around all were clear of any obstructions (apparently livestock that congregate at the boxes tramples the vegetation. The outlet works are uncontrolled, except by inlet (pipe) size. Seepage was not observed.

Findings and Corrective Actions:
a. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.

J. Spillway: (Satisfactory)
This spillway consisted of a trapezoidal channel, about 150 ft wide per site plans, with an invert elevation of 37.9 ft. The spillway is riprap lined with low grass vegetation. Side slopes are 2H: 1V. The spillway approach was clear.
There was no erosion observed near the spillway.
The downstream vegetation appears to be primarily pasture grass.

Findings and Corrective Actions:
a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.

K. Down Stream Channel: (Unknown)
The down stream channel was not investigated / inspected.

XI. Additional Comments:

Original field inspection notes were scanned and are attached to this summary report. Included are several photos from the site visit to detail important features of the project, captioned to be self-explanatory.

Per e-mail dated 5/1/2006 12:57 pm from Joe Koester, USACE.

Access when spillway is flowing: I recommend stating access by 4-wheel drive, because there is no paved road to the spillway.
Other studies conducted? Unknown

Reservoir: Normal Operating Level/Range Empty
It does not state the range. i.e., 20 to 30 feet No gage by which to judge, except possibly at one or more of the injection well housings in the reservoir.
Was a staff gage observed at the time of inspection? No staff gage observed.
Recommend installation of gage at one of the injection wells.

Intake Works Description: Type of control and from where.
Ditch diversion control was far off site and was not inspected. There was no inflow in the inlet channel at the time of the inspection. A gate structure is presumed to control ditch flow (the ditch is concrete).

Upstream slope: Please provide information on the erosion, cracks, sinkholes and vegetation that you observed. A single, approximately 3 ft tall by 10 ft wide scarp was noted and photographed as shown in the report. This scarp was caused by cattle traffic and digging, perhaps by the horns of one of the longhorn cattle that had access to the slope at this point. Access should be restricted.

Upstream slope:
Please provide information on slope protection. The upstream slope is grass vegetated. Grass should be kept mowed and slope distress repaired and reseeded.

Outlet works:
Six injection wells are spaced around the floor of the reservoir area, approximately central to the reservoir bottom.

Spillway:
Please verify if your ratio, if the H or the V is first.
My designation of 2:1 is intended as 2 Horizontal on 1 Vertical

Vegetation: 12" nominal – please expound. Does it mean that it is no higher than 12"?
"Nominal" is intended to imply "average." Some of the grass may be as high as 24 inches, but is blown down by wind.

Downstream channel:
Are you saying that there are homes and farms downstream? Yes
Is there no drainage-way? The drainage-way was not obvious from the geography of the site. No flow was present from which to judge drainage.
Indicate items along the stream bank. It was not evident that there was a defined stream, but the spillway was directed toward a residential area, so it is likely that homes abut the stream.

Comments:
The dam is not abandoned; rather, it's purpose is control of intermittent high inflow from the diversion ditch, which was not flowing at the time of the inspection. The reservoir is well-maintained; the only repairs indicated are to re-dress the scarp on the upstream slope that was caused by cattle activity.
Did the (abandoned) dam present a safety hazard at the time of inspection? No
Would the residence by/near the downstream channel be affected in any way?
I do not believe the dam poses any significant hazard to residences downstream.

PHOTOGRAPHS

Dam ID: HA-043

Name: Puukapu Watershed Retarding Dam R-1

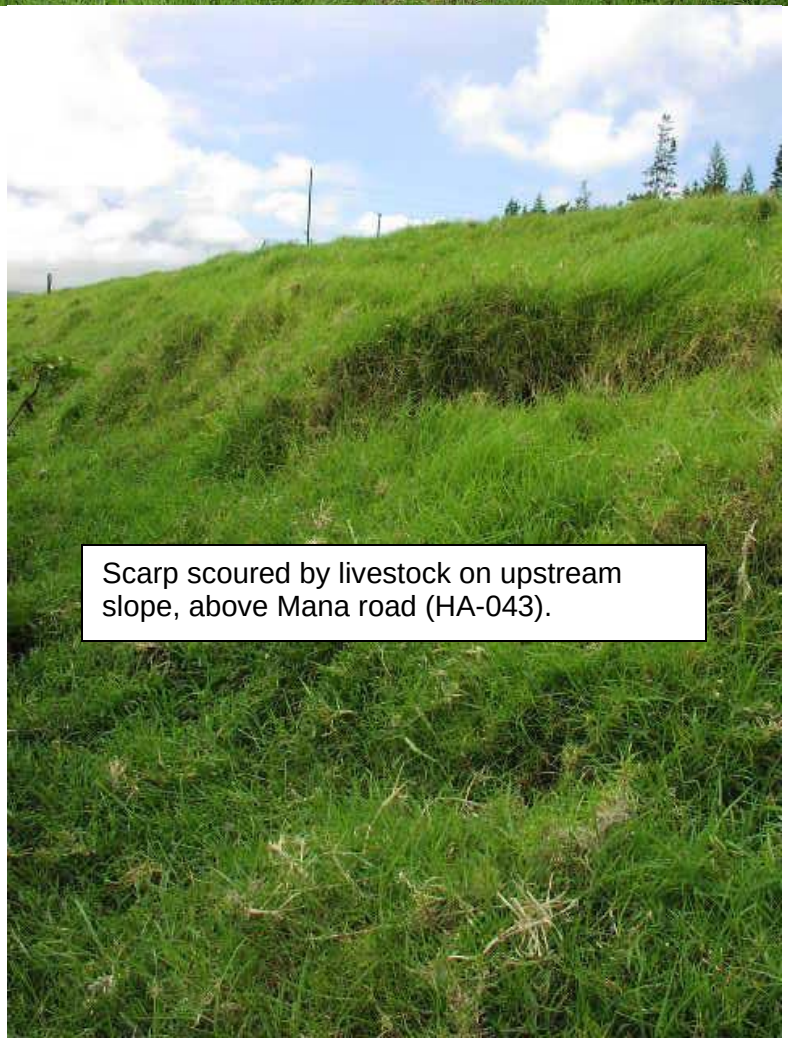
Uncontrolled, residual pool, used to water livestock (HA-043).

Embankment, viewed along axis below Mana Road (HA-043).

Dam ID: HA-043

Name: Puukapu Watershed Retarding Dam R-1

Uncontrolled dry injection well (one of six) in reservoir, used as primary outlet works (HA-043).



Scarp scoured by livestock on upstream slope, above Mana road (HA-043).

Dam ID: HA-043

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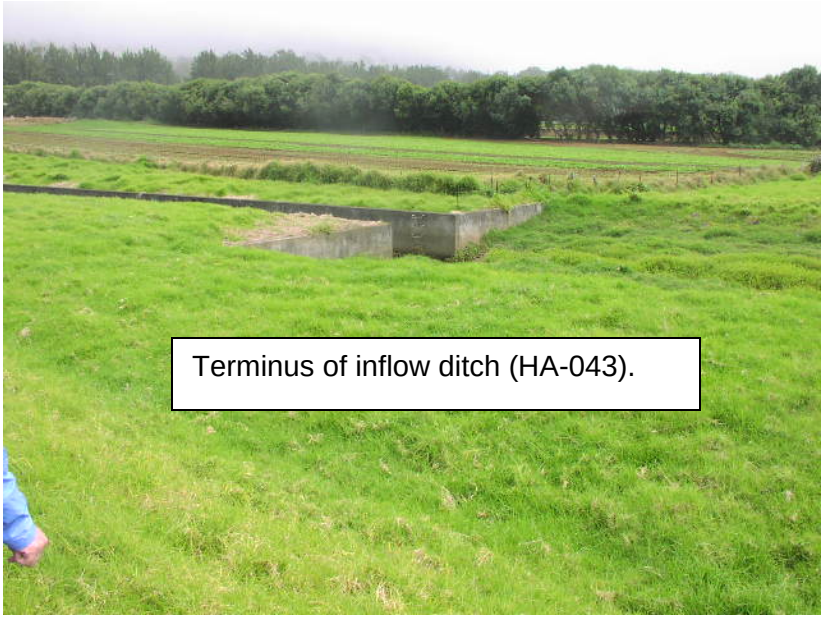
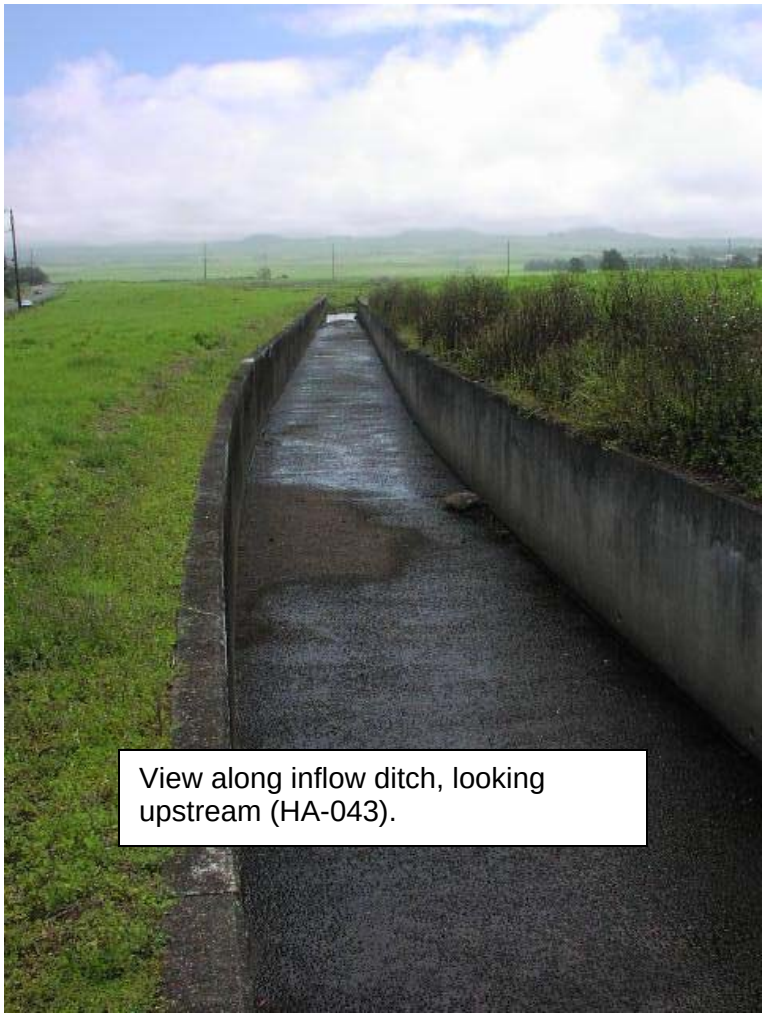


Terminus of inflow ditch (HA-043).



View along inflow ditch, looking upstream (HA-043).

FIELD INSPECTION SHEETS

Dam ID: HA-0043
PUUKAPU WATERSHED RETARDING DAM R-1

Vulnerability Index:
Extreme 1 | High 2 | Moderate 3 | Low 4

Inspection No:
Date: 4-6-06

STATE OF HAWAII - DLNR
DAM SAFETY INSPECTION SHEET

Inspection Type: Visual Dam Safety Inspection

Persons Present	Affiliation	Phone Number
JOE KORSTER	US Army Corps of Engineers	
DAVID STOLL	NRCS	
ERIC TANAKA	DLNR	
ERNEST MATSUDA	DOA	
HARRY YODA (OWNER REP)	DLNR	

Weather Condition: ☐ Rain previous day ☐ Rainy ☐ Drizzle / Mist ☐ Cloudy/Overcast ☐ Partly Cloudy ☒ Sunny ☐ Dry

Comments: 2 ACRE LOW WATER POND - "PRIMARY SPILLWAY" AGR INJECTION WELLS (HYDROFRACTURE) SIX WELLS IN RESTRICTION AREA (CWT > 1000's -) ELEV 2F20'

1. General: *(Information currently on file, update as required)*

Dam/Res. Name	PUUKAPU WATERSHED RETARDING DAM R-1		
Owner	State of Hawaii, Department of Land & Natural Resources		*(C045)*
Owner Contact	Mr. Russell Tsuji	Owner Ph.	
Lessee	Spensor Shutty	Lessee Ph.	
O & M Contractor		O & M Ph.	
Nearest Town	WAIMEA KUHIO VILLAGE	Latitude	20.0333 ° (decimal)
County	HAWAII	Longitude	155.635 ° (decimal)
Tax Map Key(s)	64031:7,9,10 & 64008:1,12		

Dam Status	A:	Hazard Potential	H:	Dam Size	
Year Completed	1965	Dam Length	4340 ft.	Dam Height	10 ft.
Normal Storage	ac.ft.	Max. Storage	945 ac.ft.	Max. Surface Area	ac.
Drainage Area	3.05 mi.	Spillway Type	6 - INJ WELLS, 1 OVERFLOW SPILLWAY	Max. Spillway Q	2000 cfs

Owner owns land under dam facility:
Emergency Action Plan on file with the Department: NO
Reports on file with the Department: July 1996 = Dam Safety Inspection, Woodward Clyde (8)
March 1979 = Army Corps of Engineers, Initial Dam Safety Inspection / Survey (2)

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PUUKAPU WATERSHED RETARDING DAM R-1

Inspection No: _____
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2. Questions for Owner's Rep.:

	Yes	No	Unknown	Comments
Construction Plans Available	☑	☐	☐	
Site / Facility Map	☑	☐	☐	
Operation & Maintenance Manual	☐	☐	☑	
Emergency Action Plan	☐	☐	☑	
Modifications / Improvements	☐	☑	☐	
Conduct Routine Inspections	☑	☐	☐	ANNUAL
Conduct Routine Maintenance	☑	☐	☐	
Vehicle access to site	☑	☐	☐	☐ Not accessible ☐ With Standard car ☐ Requires 4-Wheel Drive
Access during heavy rains	☑	☐	☐	☐ Not accessible ☐ With Standard car ☐ Requires 4-Wheel Drive
Access when spillway is flowing RAM	☐	☐	☐	☐ Not accessible ☐ With Standard car ☐ Requires 4-Wheel Drive
Other Studies Conducted	☐	☐	☐	☐ Phase I ☐ Phase II ☐ Hydraulics ☐ Stability ☐ Hazard ☐ Seismic ☐ Other: _____
Incident History	☐	☑	☐	☐ Breached ☐ Overtop ☐ Slide ☐ Down stream Flooding ☐ Other: _____
Reservoir's Current Use	☐	☐	☐	☐ Sediment ☐ Irrigation ☐ Recreation ☑ Flood Control ☐ Drinking Water ☐ Power Generation ☐ Other: STOCK & WILDLIFE

Findings and Corrective Actions:

- ☑ a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
- ☐ b. An Emergency Action Plan (EAP) is on file with the department, submit any updates as applicable.
- ☑ c. An EAP is required for High Hazard Dams. Submit an updated EAP for this facility.
- ☐ d. An EAP is recommended for all dams regardless of hazard class. Submit EAP if developed for the facility.
- ☐ e. Submit narrative and additional information detailing the improvements, modifications, and/or alterations at the dam site, unless covered by approved dam permit.
- ☐ f. Routine inspection logs were not inspected.
- ☑ g. Dam owners shall provide for routine inspection of the dam.
- ☐ h. The dam did not appear to be maintained on a regular basis.
- ☑ i. Access to site appears to be satisfactory.
- ☐ j. There is no vehicular access to the dam site. Operational and emergency plans need to reflect this deficiency or access provided.
- ☐ k. Access to dam is questionable during severe weather conditions and/or spillway overflows. Operational plans and emergency plans need to reflect this deficiency or access provided.
- ☐ l. Provide a detailed narrative of the incident, responses taken, and any damages incurred. Dam owners are required to promptly advise the department of any sudden or unprecedented flood or unusual or alarming circumstance or occurrences which may adversely affect the dam or reservoir.
- ☐ m. Submit current Operations and Maintenance Manual or Procedures for this dam / reservoir facility.
- ☐ n. Submit Site or Facility Map of this Dam which identifies the location of major features including outlet works controls and conduits.
- ☐ o. _____

Additional Requirements:

The following investigative study(s) are:

Required	Recommended	
☐	☐	Phase I Study
☐	☐	Phase II Study (Including ☐ Seepage ☐ Hydrology/Hydraulics ☐ EAP)
☐	☐	Hydrology and Hydraulics (including Probable Maximum Flood and spillway capacity)
☐	☐	Stability Analysis
☐	☐	Seismic Analysis
☐	☐	Hazard Classification
☐	☐	Other: _____

Dam ID: HA-0043
PUUKAPU WATERSHED RETARDING DAM R-1

Inspection No: _____
Date: 4-6-06

Physical Dam Features: (Check All Applicable. Provide description of Items Observed and/or Take Photos. Indicate photo # in description.)

3. Reservoir:

Level during inspection 2-3 ft per ESTIMATE (gage / other)

Normal Operating Level/Range SAME ft per _____ (gage / other)

Description: LOW WATER, NO LOW-LEVEL OUTLET EXCEPT CREEK *

Typical Operation ☐ Spillway always flowing ☐ Kept within normal range ☐ Kept Empty ☐ Drained Daily ☑ Only filled by Storms
☐ Other: _____

Sinkhole in Res.: ☐ # Observed: _____ Size: _____ by _____ in. Deep ☐ Not Visible ☑ None Observed
Description: _____

Staff Gage: Description: _____

* WATER OVERFLOWS

Findings:

☐ a. The reservoir was not inspected.
☑ b. The reservoir appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ c. The reservoir appeared to be in fair to poor condition and requires corrective action.
☐ d. The reservoir appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

☐ e. The staff gage needs maintenance and/or repair. Description: _____
☐ f. A staff gage was not observed at the reservoir. Provide some method of quantifying the water level within the reservoir.
☐ g. A sinkhole was observed in the upstream reservoir. Conduct additional investigations and monitoring to identify the cause, risk and appropriate action.
☐ h. _____

4. Intake (Inflow) Works Description:

☐ Number of Intakes 1 IN ADDITION TO OVERLAND TO THIS LOW SPOT
☐ Intake Culvert / Pipe
Size: _____ in. ☐ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other _____
Control: ☐ Gate ☐ Valve ☐ Flow can either be Shut off or Bypassed
From: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☐ Other _____

☑ Ditch / Flume
Dimension: 5' DEEP 12' W (Size x Depth) Shape RECTANGULAR
Surface: ☐ Dirt ☐ Wood ☑ Concrete ☐ Lined w/_____
Control: ☐ Gate ☐ Valve ☐ Flow can either be Shut off or Bypassed NOTCH WEIR, UNCONTROLLED
From: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☐ Other _____

Findings:

☑ a. The intake works were not inspected.
☑ b. The intake works were not tested.
☐ c. The intake works appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ d. The intake works appeared to be in fair to poor condition and requires corrective action.
☐ e. The intake works appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

☐ f. The intake works needs maintenance and/or repair. Description: _____
☐ g. _____

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Inspection No: _____
Date: 4-6-06

5. Upstream Slope: **(Typical Slope ± 2½H : 1V)**

Slope Protection: ☑ None ☐ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☐ Liner _____ ☐ Other: GRASS
☐ Defect in Protection: Description: NONE ; GOOD GRASS COVER

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☐ None Observed
Description: 20' WIDE SMALL SLUMP, STARTED BY CATTLE, APPEARS STABLE IN 1000' SOUTH OF NORTH ABUTMENT

Cracks: ☑ Parallel with crest ☐ Perpendicular to crest ☑ Slide visible ☐ Not Visible ☐ None Observed
Description: APPROX. 3' D.S. FROM CREST

Sinkholes: ☐ # Observed: _____ Size: _____ and _____ Depth ☐ Not Visible ☐ None Observed
Description: _____

Vegetation: ☐ None ☐ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: _____

Findings:

- ☐ a. The upstream slope was not inspected.
- ☐ b. The upstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☑ c. The upstream slope appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The upstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Slope protection needs maintenance or repair. Description: _____
- ☑ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: RESTRICT CATTLE ACCESS TO U.S. SLOPE
- ☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ i. The upstream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ j. Tree(s) were observed on the dam embankment. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☑ k. CATTLE TRAILS ; NOT REQUIRED

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6. Crest: Approximate Crest Width: 13'

Access: ☐ None ☐ Walking Path ☑ Roadway, Surface / Width / Usage: UNPAVED, GRADED, LITTLE TRAFFIC

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☑ None Observed
Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☑ None Observed
Description: _____

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☐ Not Visible ☑ None Observed
Description: _____

Vegetation: ☐ None ☑ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: Good Grass

Findings:

- ☐ a. The dam crest was not inspected.
- ☑ b. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The dam crest appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The dam crest appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Access along the crest was satisfactory.
- ☐ f. Access along the crest was not possible. Description: _____
- ☐ g. Rut and/or Gully erosion was observed on the crest, which requires maintenance and/or repair. Description: _____
- ☐ h. A crack was observed on the crest, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ i. A sinkhole was observed on the crest, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ j. Portions of the crest were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ k. Tree(s) were observed along the dam crest. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ l. _____

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7. Downstream Slope:

(Typical Slope ± 2½H : 1V)

Access: ☐ lower roadway along toe ☐ roadway to outlet works ☐ walkway to outlet works ☑ None Observed

Slope Protection: ☐ None ☐ Dumped Rock ☐ Rip Rap ☐ Grouted Rip Rap ☐ Concrete

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☑ None Observed
Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☑ None Observed
Description: _____

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☐ Not Visible ☑ None Observed
Description: _____

Vegetation: ☐ None ☑ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: Good grass cover.

Seepage:
Seep Spot Number 1
☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☑ None Observed
☐ Flowing, Description: _____
Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____
Description: _____

Seep Spot Number 2
☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed
☐ Flowing, Description: _____
Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____
Description: _____

Findings:

- ☐ a. The downstream slope was not inspected.
- ☑ b. The downstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The downstream slope appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The downstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Slope protection needs maintenance or repair. Description: _____
- ☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: _____
- ☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ i. The down stream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ g. Tree(s) were observed on the downstream slope. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ h. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
- ☐ i. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.
- ☐ j. The slope was very steep, around a 1 to 1 slope, further study is required to verify slope stability.
- ☐ k. _____

Dam ID: HA-0043
PUUKAPU WATERSHED RETARDING DAM R-1

Inspection No: _____
Date: 4-6-06

8. Abutments/Toe:

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☑ None Observed
Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☑ None Observed
Description: _____

Vegetation: ☐ None ☑ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: _____

Seepage: Seep Spot Number 1
☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☑ None Observed
☐ Flowing, Description: _____
Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____
Description: _____

Seep Spot Number 2
☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed
☐ Flowing, Description: _____
Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____
Description: _____

Findings:

☐ a. The abutments/toe were not inspected.
☑ b. The abutments/toe appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ c. The abutments/toe appeared to be in fair to poor condition and requires corrective action.
☐ d. The abutments/toe appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. Slope protection needs maintenance or repair. Description: _____
☐ f. Rut and/or Gully erosion was observed, which requires maintenance and/or repair. Description: _____
☐ g. A crack was observed along the abutments/near the toe, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
☐ h. The abutment/toe area was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
☐ i. Tree(s) were observed along the abutment/toe. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
☐ j. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
☐ k. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.
☐ l. _____

9. Outlet Works:

Culvert / Pipe

Type / Size: INJECTION WELLS (6 TOTAL TO DIFFERENT DEPTHS) 2'6" DIA

Culvert: ☐ Concrete ☐ Masonry ☐ unlined earth ☐ Other _____

Pipe: ☐ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other _____

Control Type: ☐ Gate ☐ Valve ☒ Other SCREEN INLETS, OPEN

Location: ☐ Control on Upstream side ☐ Control on Downstream side

Seepage: ☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

☒ a. The outlet works were not inspected.

☐ b. The outlet works were not tested.

☑ c. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.

☐ d. The outlet works appeared to be in fair to poor condition and requires corrective action.

☐ e. The outlet works appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ f. Seepage/Ponding water was observed. Conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.

☐ g. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area. Failures caused by seepage/piping along the outlet conduit are very common and are considered to be a dangerous situation.

☐ h. Were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

☐ i. _____

☐ j. _____

Dam ID: HA-0043
PUUKAPU WATERSHED RETARDING DAM R-1

Inspection No: _____
Date: 4-6-06

10. Spillway:

Type: ☐ None ☐ Culvert/Pipe ☑ Channel
Description: TRAPEZOIDAL, RIP RAPPED, HEAVILY GRASSED; 2:1 SIDE SLOPES

Dimension: 150' BOTTOM ft. Invert elevation: 37.9 ft. per ~~staff gage~~ PLANS

Slope Protection: ☐ None ☑ ~~Grass~~ ☑ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☐ Concrete
☐ Defect in Protection: Description: 12" SIZE BASALT

Approach: ☑ Clear ☐ High Veg. ☐ Trees ☐ Other: _____

Erosion: ☐ Scour ☐ Gully ☐ Headcut ☑ ~~Not~~ Observed ☐ Other: _____
Description: _____

Vegetation: ☐ None ☐ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: PASTURE GRASS, 12" NOMINAL

Findings:

☑ a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ b. The Spillway appeared to be in fair to poor condition and requires corrective action.
☐ c. The Spillway appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ d. Slope protection needs maintenance or repair. Description: _____
☐ e. The spillway approach was blocked. Clear approach.
☐ f. Severe scour erosion was observed which requires maintenance and/or repair.
Description: _____
☐ g. A headcut (vertical drop in channel due to erosion) was observed downstream of the spillway. Corrective action is required to prevent this problem from moving upstream.
☐ h. Trees are unacceptable in the spillway channel and approach. Take corrective action to address the woody vegetation problem and repair the damaged area.
☐ i. Unclear if spillway is adequately sized. Spillway should pass the probable maximum flood. Verify spillway capacity and take corrective action as required.
☐ j. _____

11. Down Stream Channel:

Name: NONE: OVERLAND FLOW

Downstream: ☐ Sump ☐ Open Area ☐ Un-Defined Drainage-way ☐ Defined Drainage-way ☑ Other RESIDENCES, FARMS

Items along Stream Bank: ☐ None ☐ Road ☐ Houses ☐ Town ☐ Not Inspected

Description: _____

Findings:

☑ a. The downstream channel was not inspected.
☐ b. The downstream channel appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ c. The downstream channel appeared to be in fair to poor condition and requires corrective action.
☐ d. The downstream channel appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. _____

Additional Comments:

On the date of this limited visual inspection, there appeared to be no immediate threat to the safety of the dam. No assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

Limitations and Intent of this Dam Safety Inspection:

This Dam Safety Inspection was conducted to assess the general overall condition of the reservoir/dam, identify visible deficiencies, and recommend areas of for monitoring, additional investigative studies and corrective actions. The inspection is based only on visible features/areas of the dam on the day of inspection. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies. The inspection was conducted under the authority of the Hawaii Revised Statures Chapter 179D, and Hawaii Administrative Rules, Title 13, Chapter 190, titled "Dams and Reservoirs". Questions regarding this inspection should be forwarded to the Hawaii State Dam Safety Program; PO Box 373; Honolulu, Hawaii 96809; Ph. (808) 587-0236.

Revised: Dec. 1, 2003